Overview of Climate Change Modeling Work at DWR

BDCP Steering Committee

July 25, 2008

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Modeling Support Branch
Bay Delta Office, DWR

What risks does climate change pose for the management of California's water resources?

GOALS

Provide qualitative and quantitative estimates of impacts and **likelihoods** of climate change on California's water resources

Provide information that is **relevant** to water resources decision makers

Building Coalitions

Our new friends at **UC Irvine**

SCRIPPS Institute of Oceanography

U.S. Geological Survey

Lawrence Livermore Lab

Santa Clara University

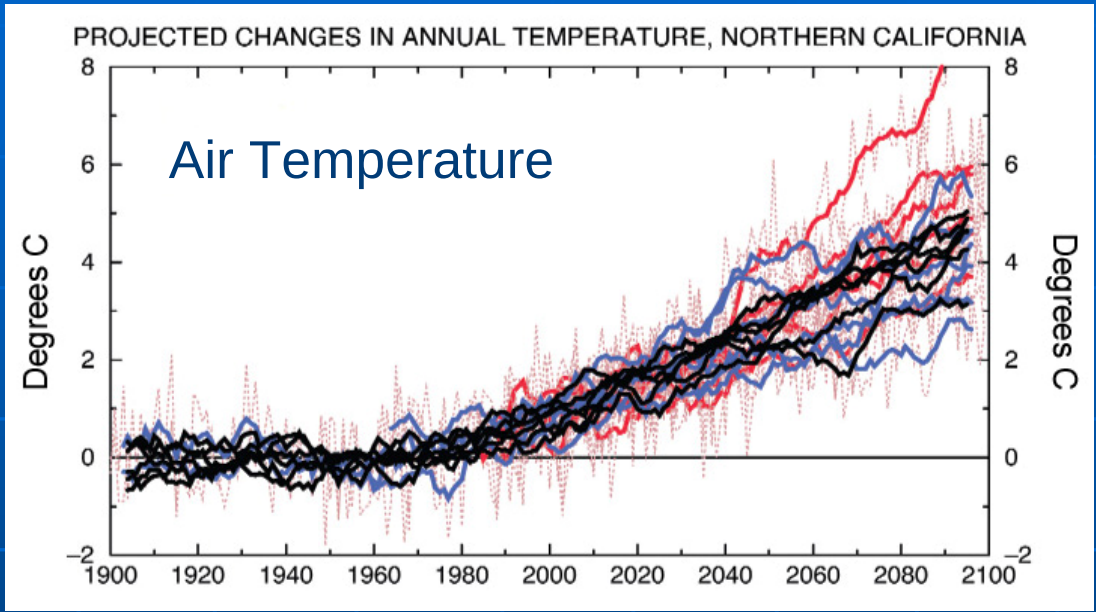
Lawrence Berkeley Lab

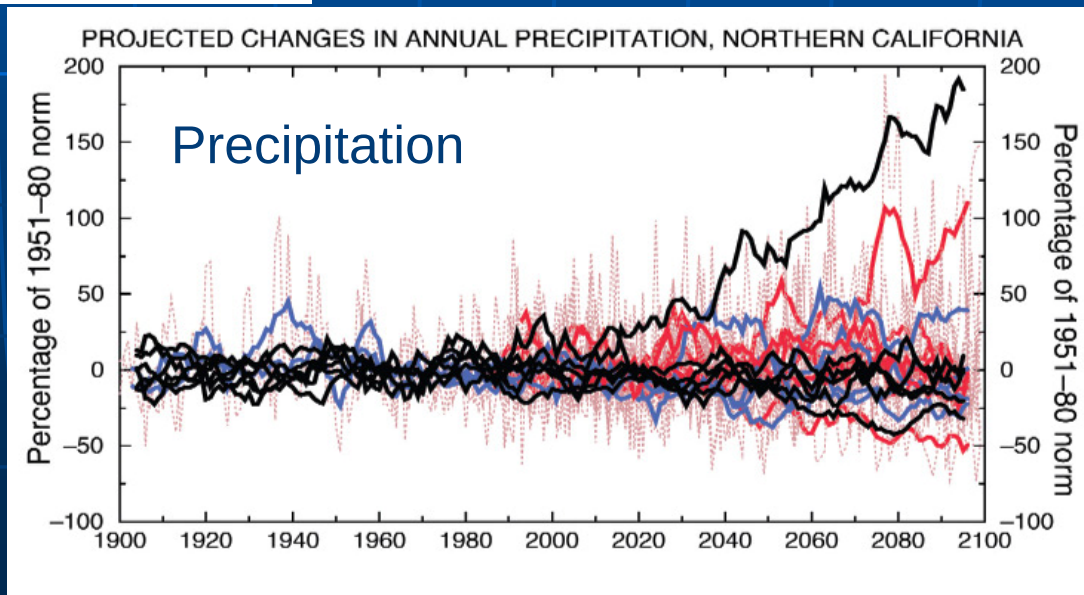
UC Davis

California Energy Commission

UC Berkeley

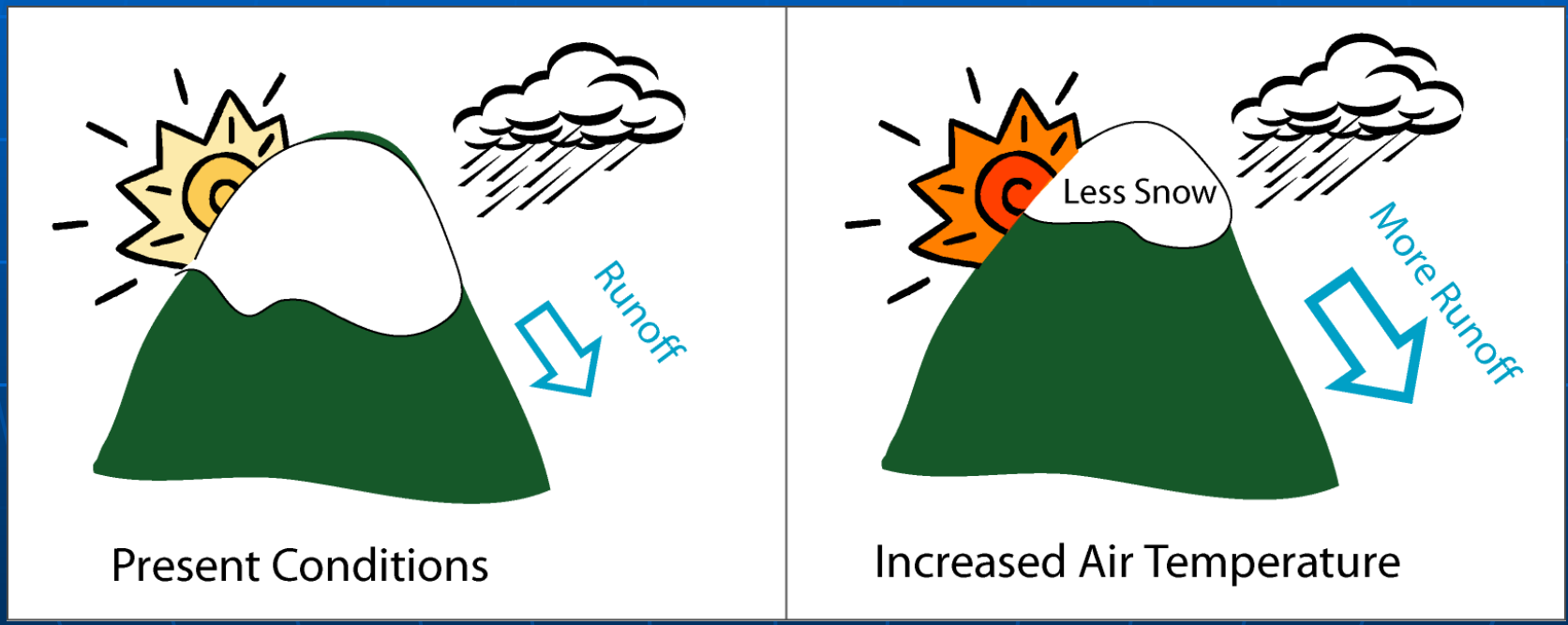
Climate Projections for California





Based on IPCC Scenarios
From Dettinger, 2005

Less Snow and Melts Sooner



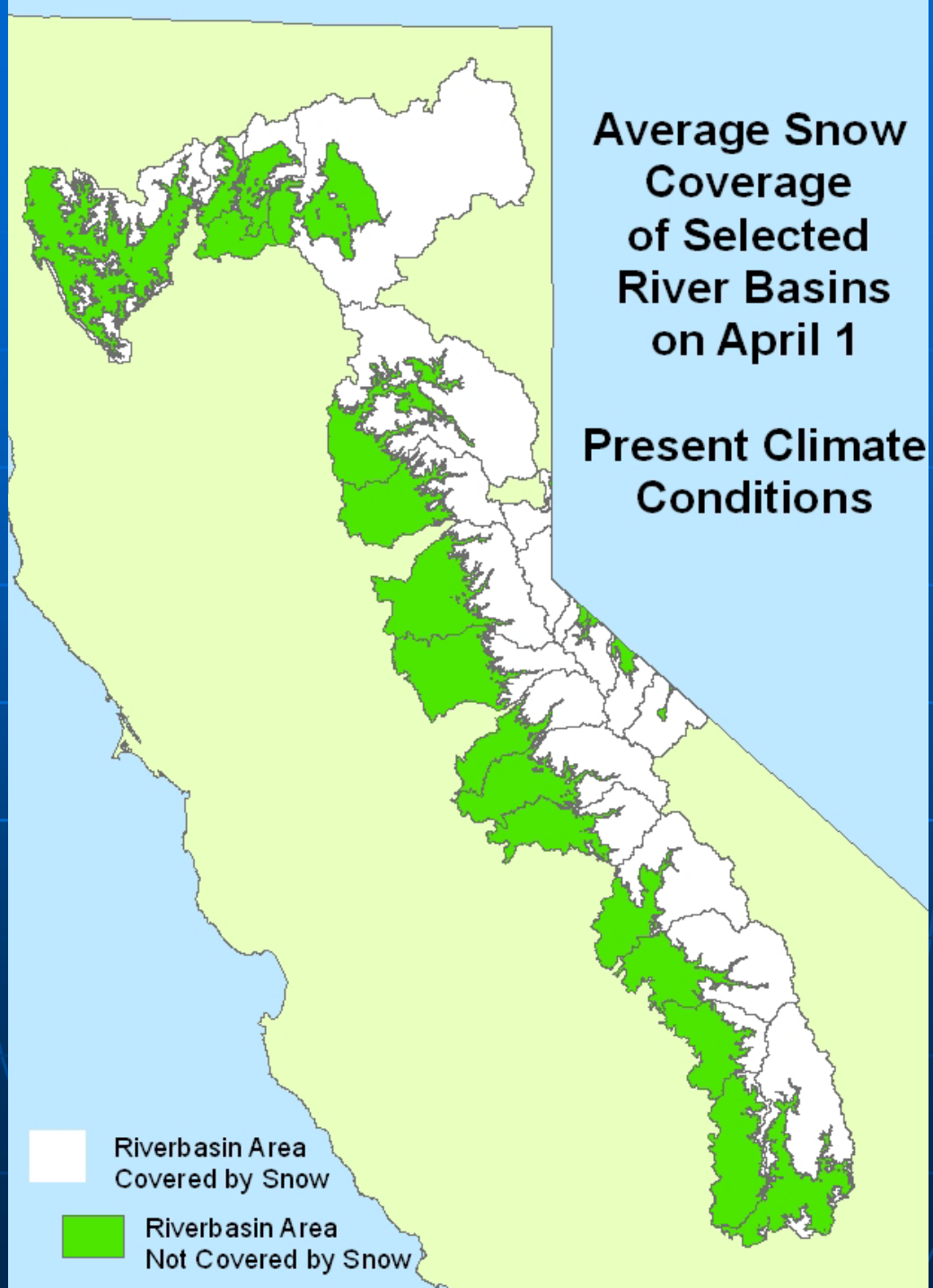
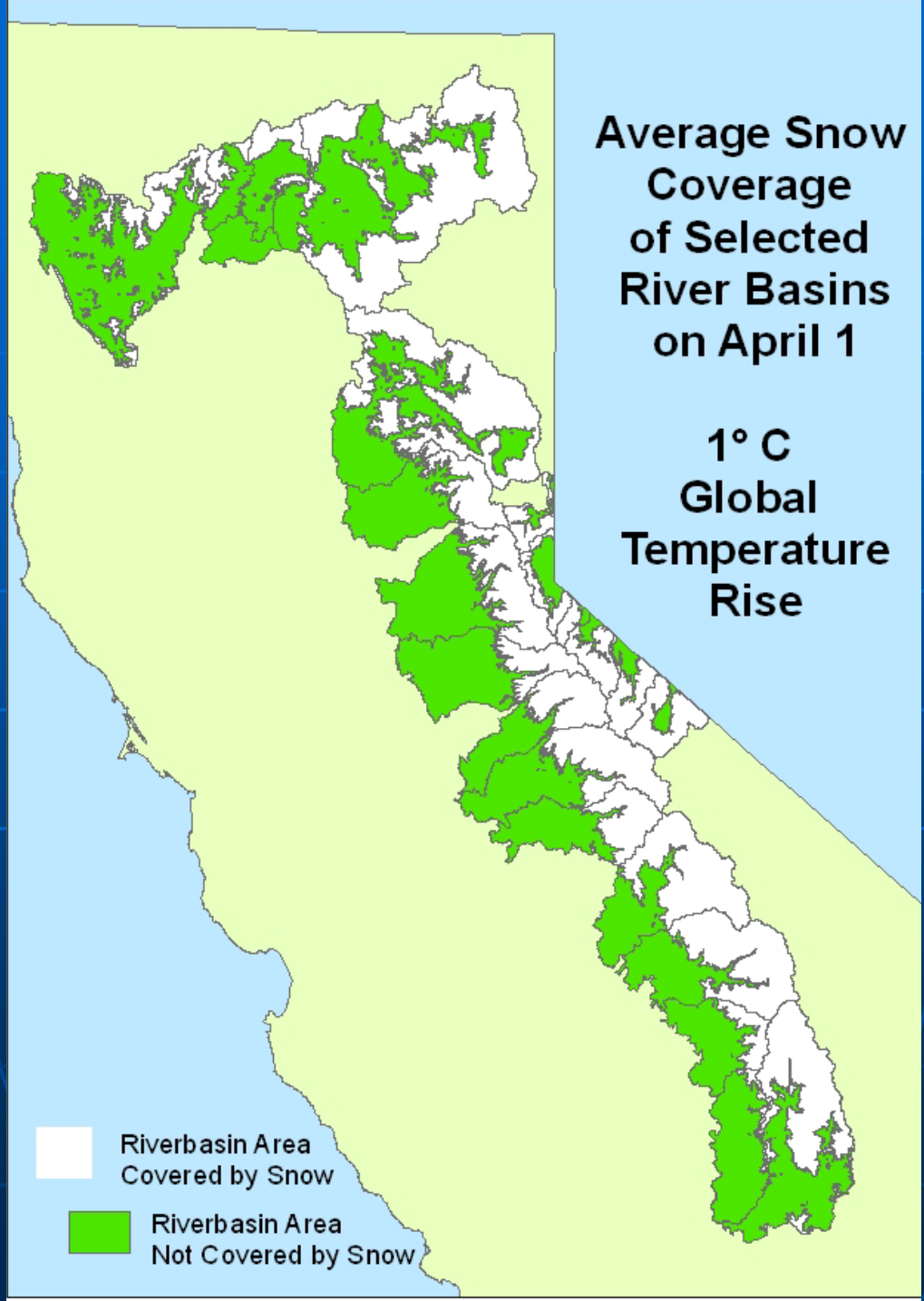


Image by Jane Schafer-Kramer DWR-Bay Delta Office



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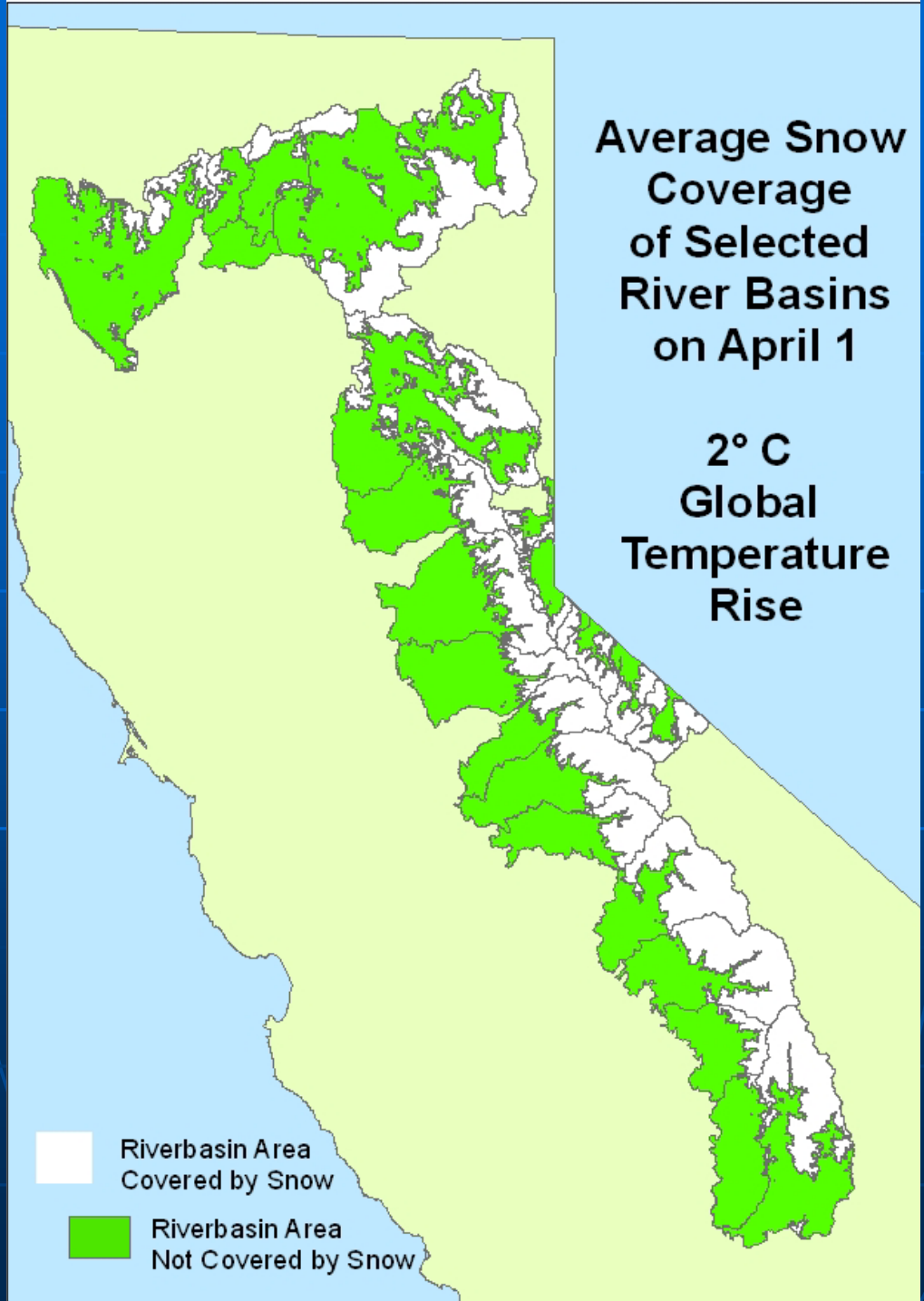

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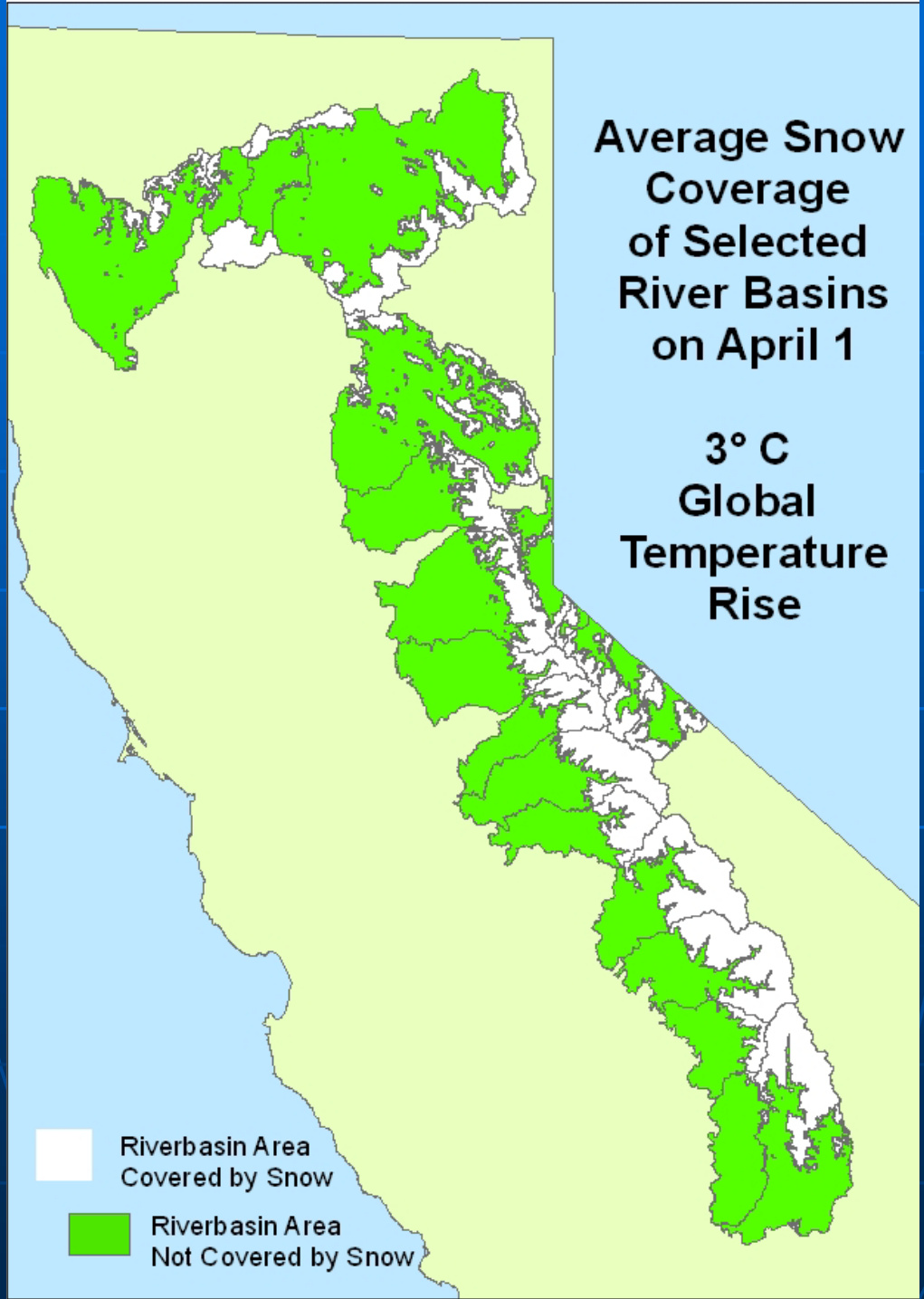

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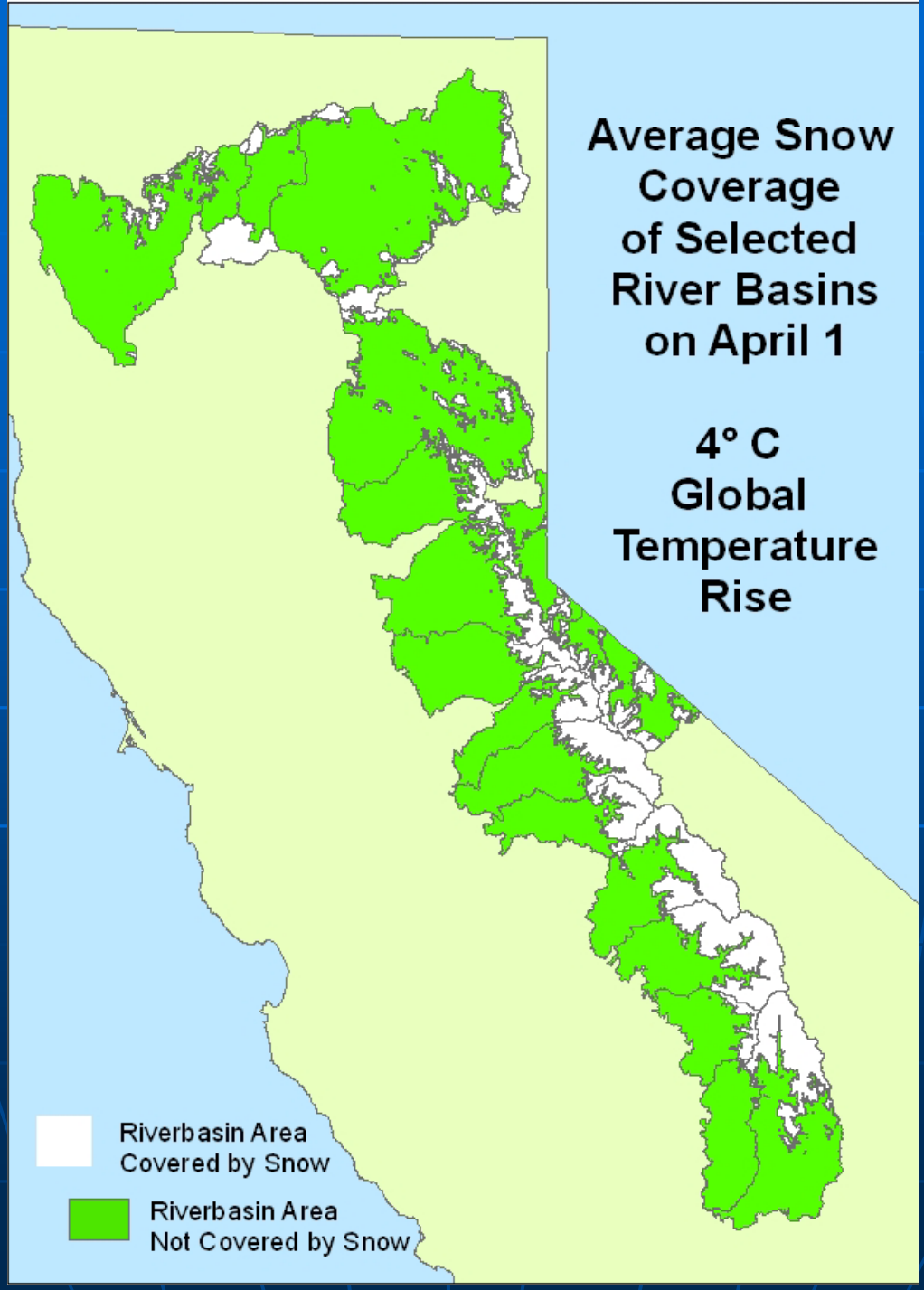

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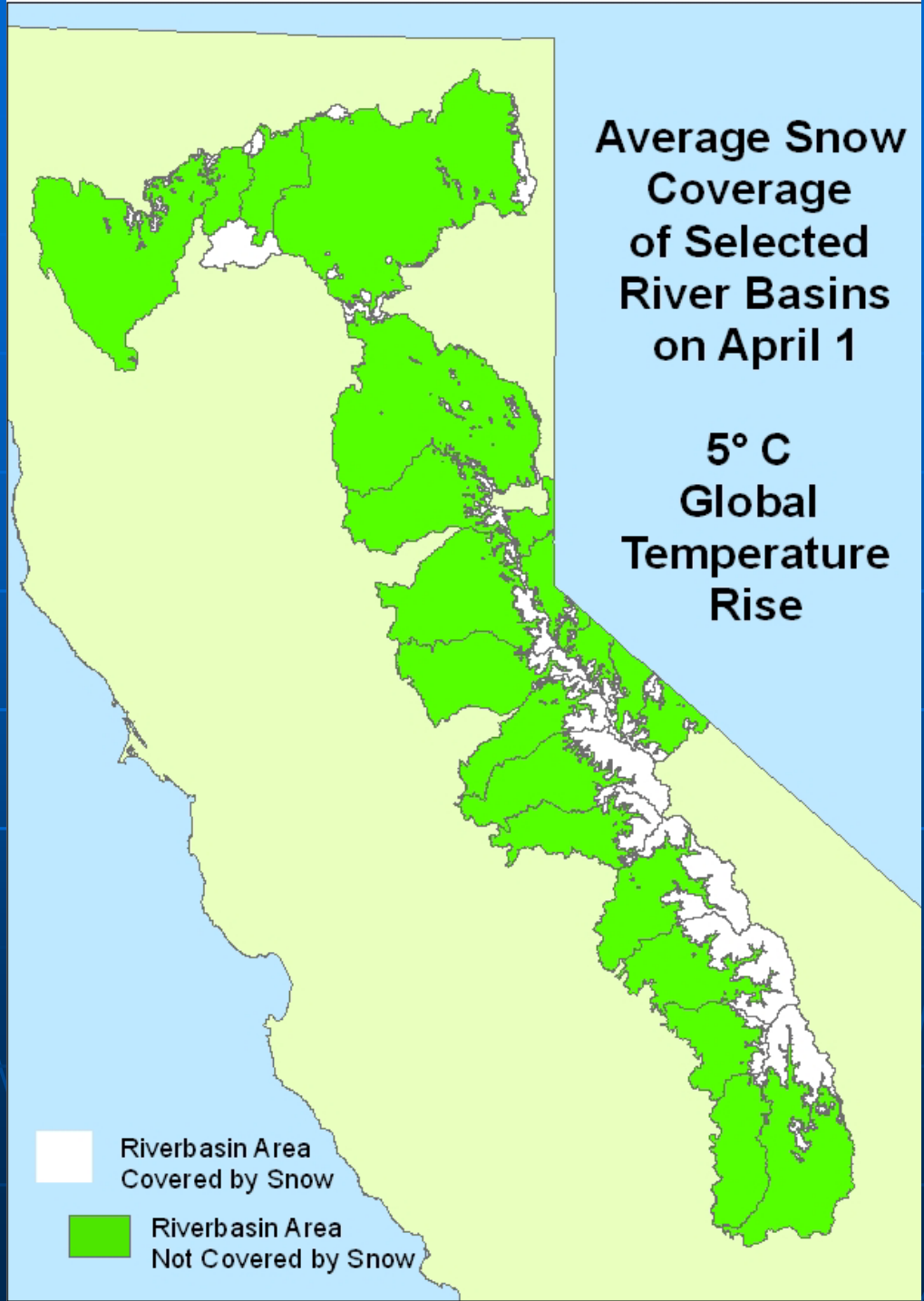


Image by Jane Schafer-Kramer DWR-Bay Delta Office

Snowpack Changes

Climate Research Division

Evolution of Average Annual Snow Water Equivalent
as a Percentage of Average 1995-2005 Values

(effect of temperature changes only: historical P, baseline T from WY 1965-1987)

2030
95% of present

2060
64% of present

2090
48% of present

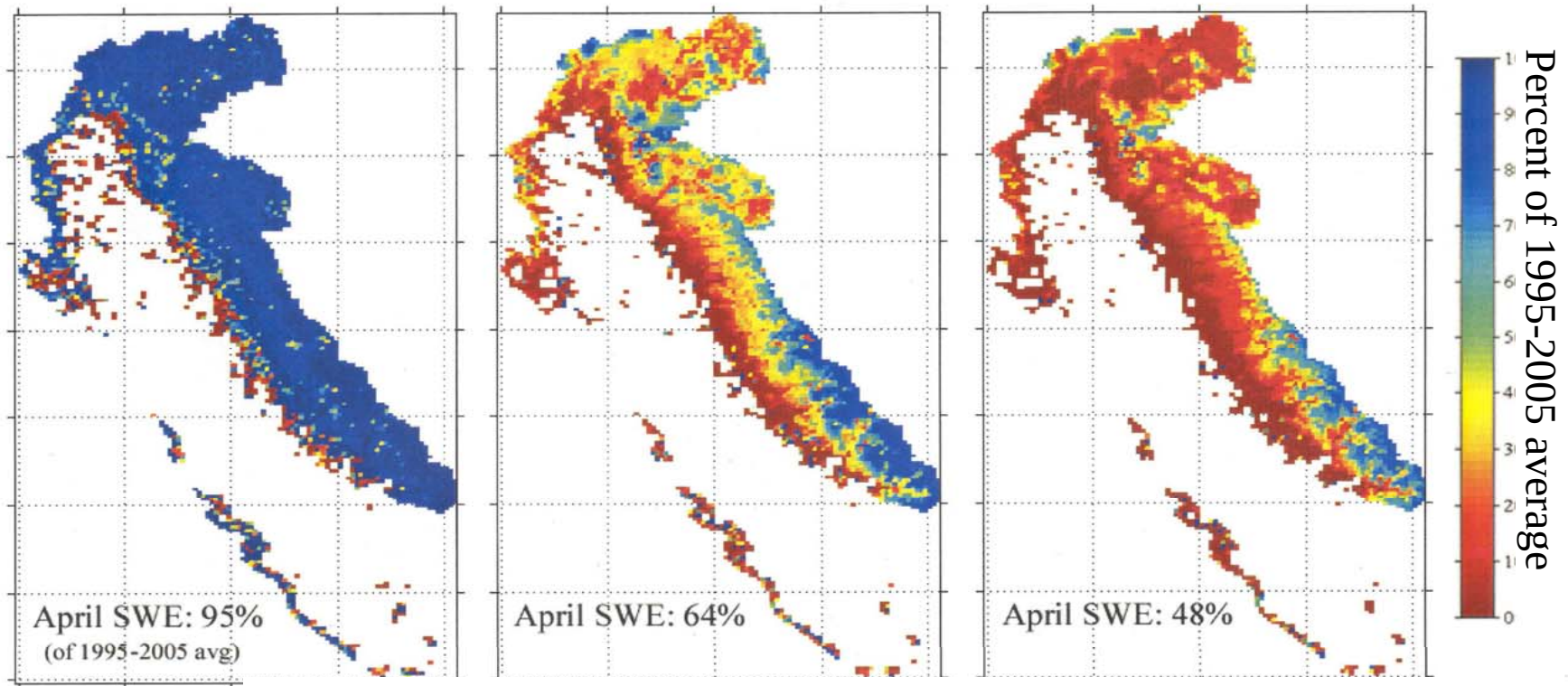
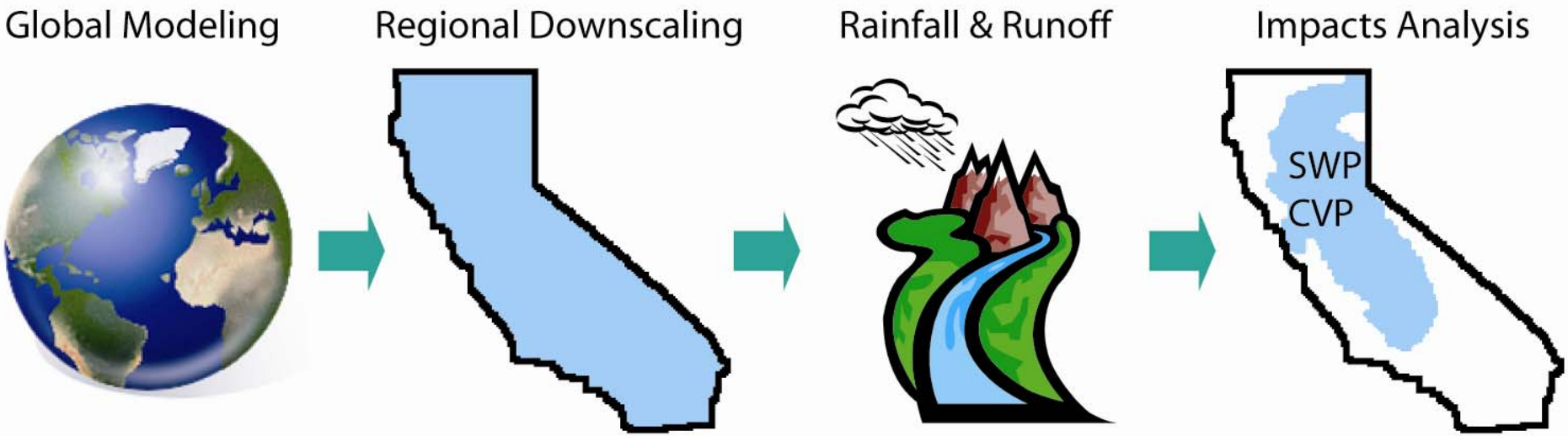


figure by N. Knowles

SWE = Snow Water Equivalent

GCM Scenario-based Impact Assessment Methodology

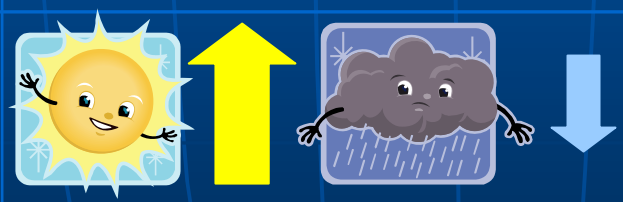
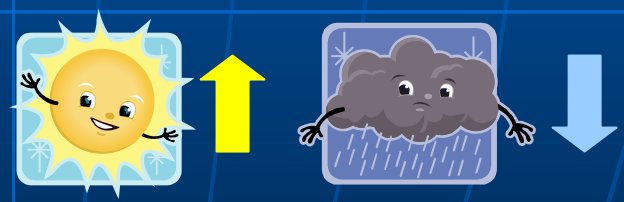
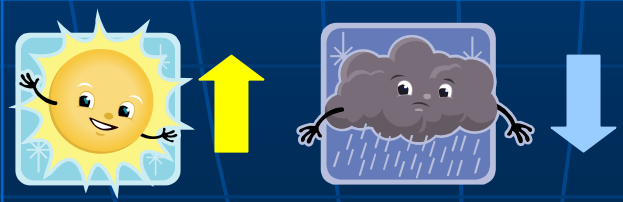


SWP= State Water Project CVP=Central Valley Project

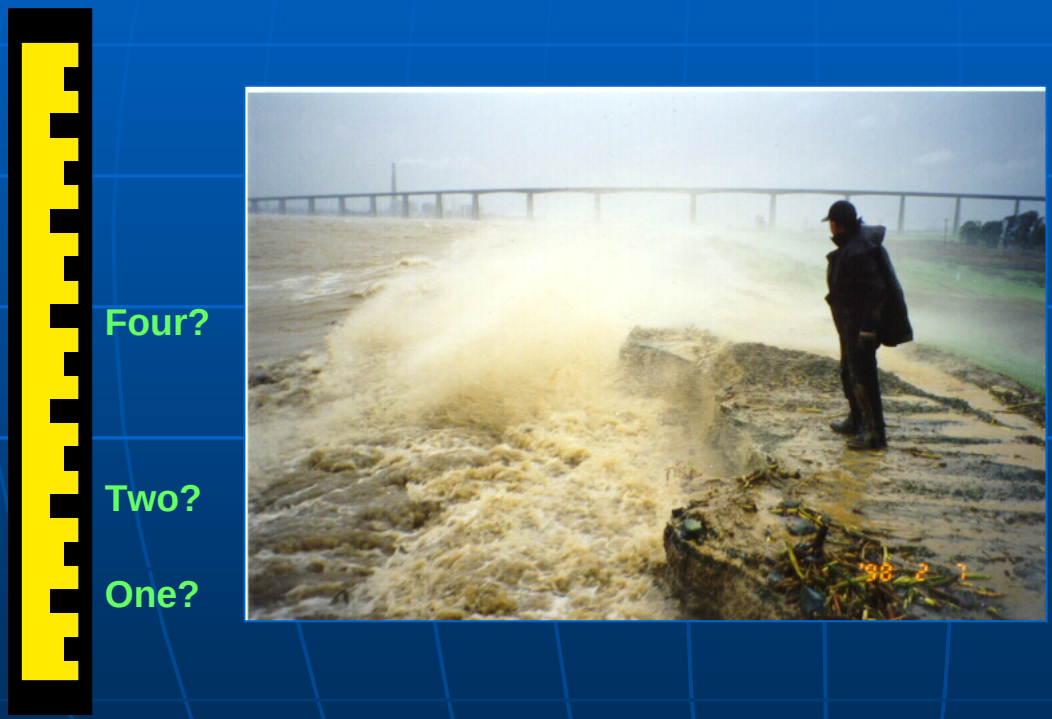
2006 Impacts Assessment

In response to Executive Order S-3-05

2 GHG emissions scenarios x 2 GCM models

Scenario / Model	A2	B1
GFDL		
PCM		

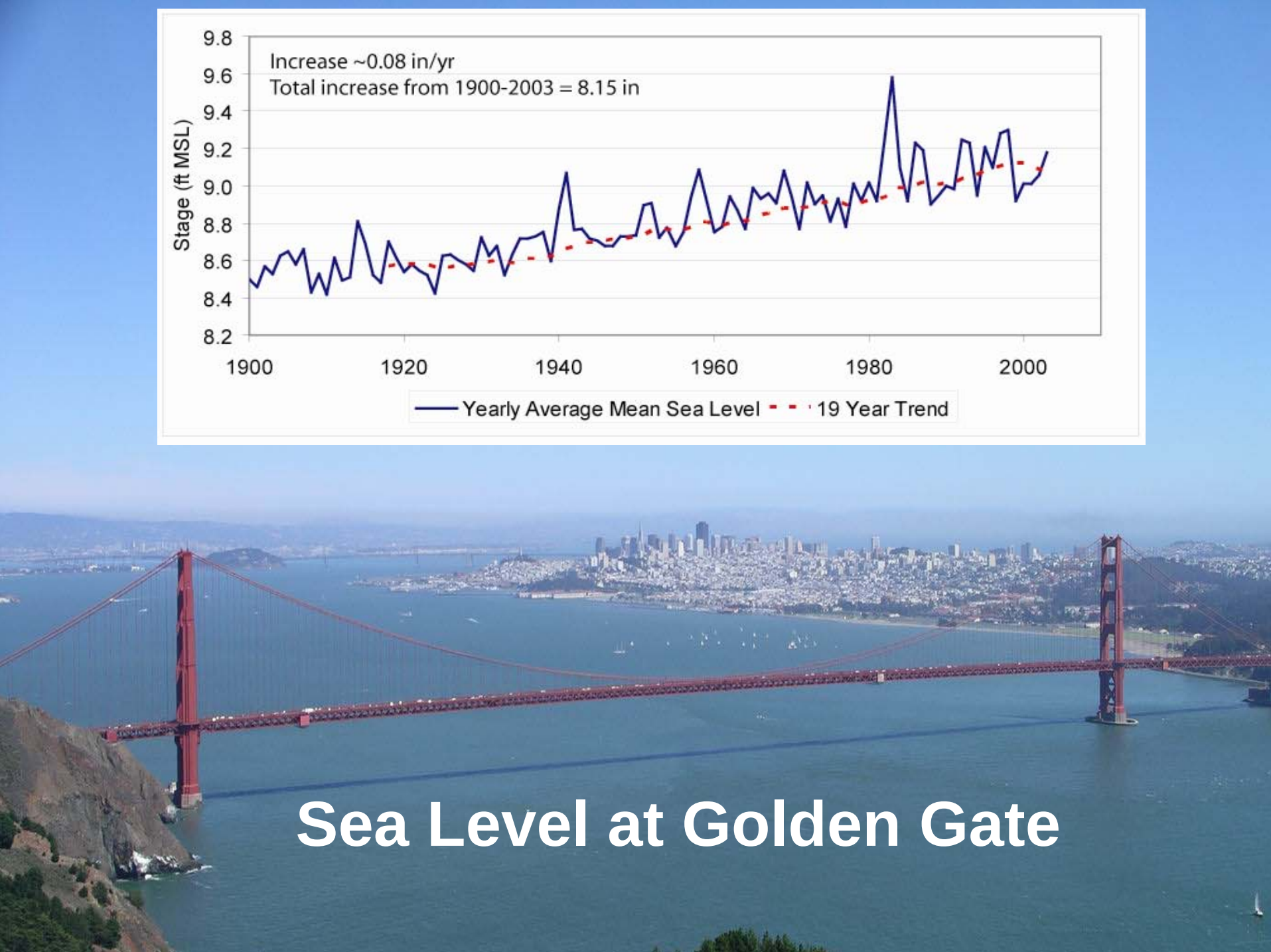
Implications of Rising Sea Level for the Delta



Increasing threat of

- salinity intrusion
- flood
- levee failure
- inundation
- habitat changes/loss

San Francisco Bay and Delta



Sea Level at Golden Gate

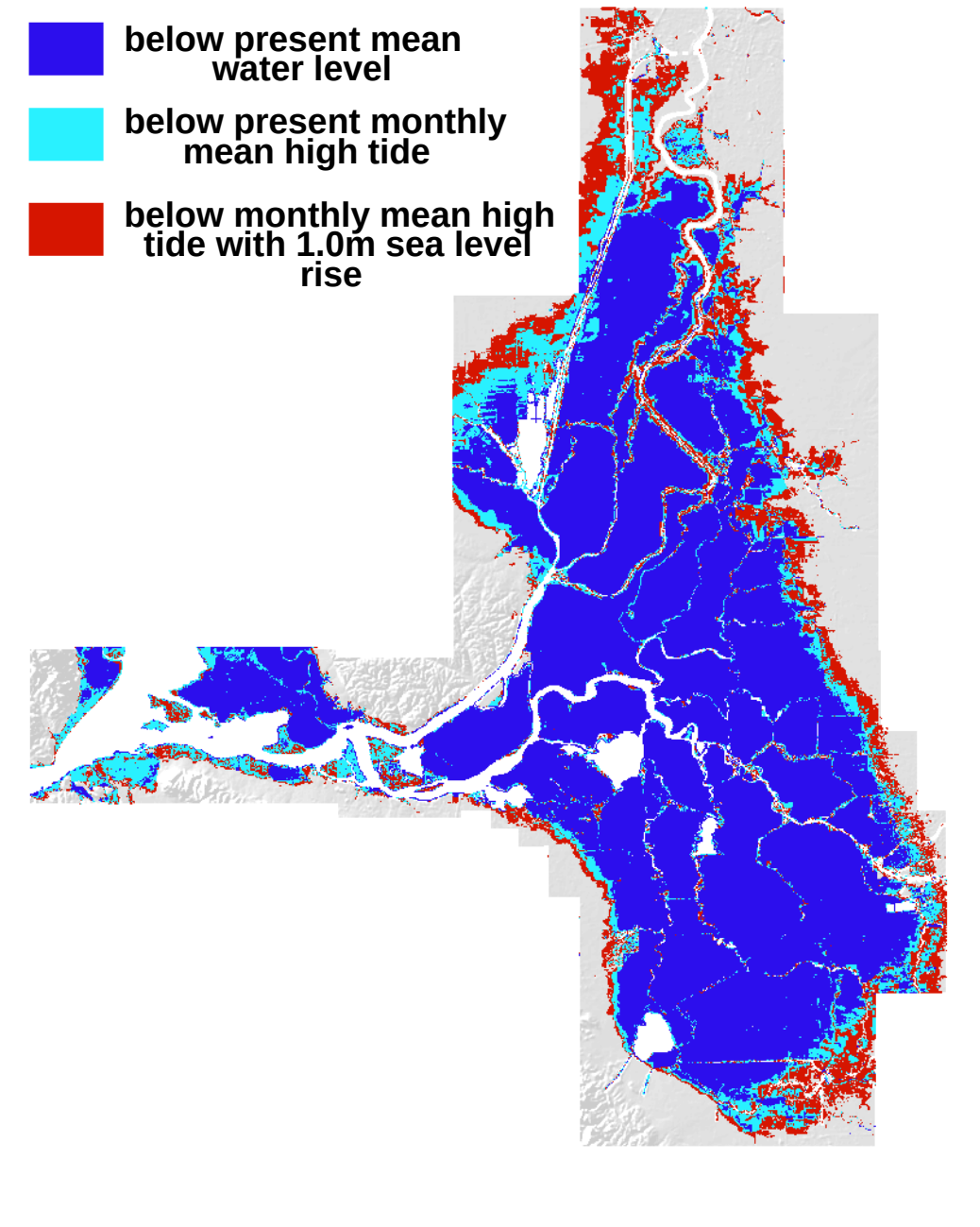
Vulnerability of The Delta

About 300 km² newly at risk of monthly inundation under a 1.0 m sea level rise are shown in red.

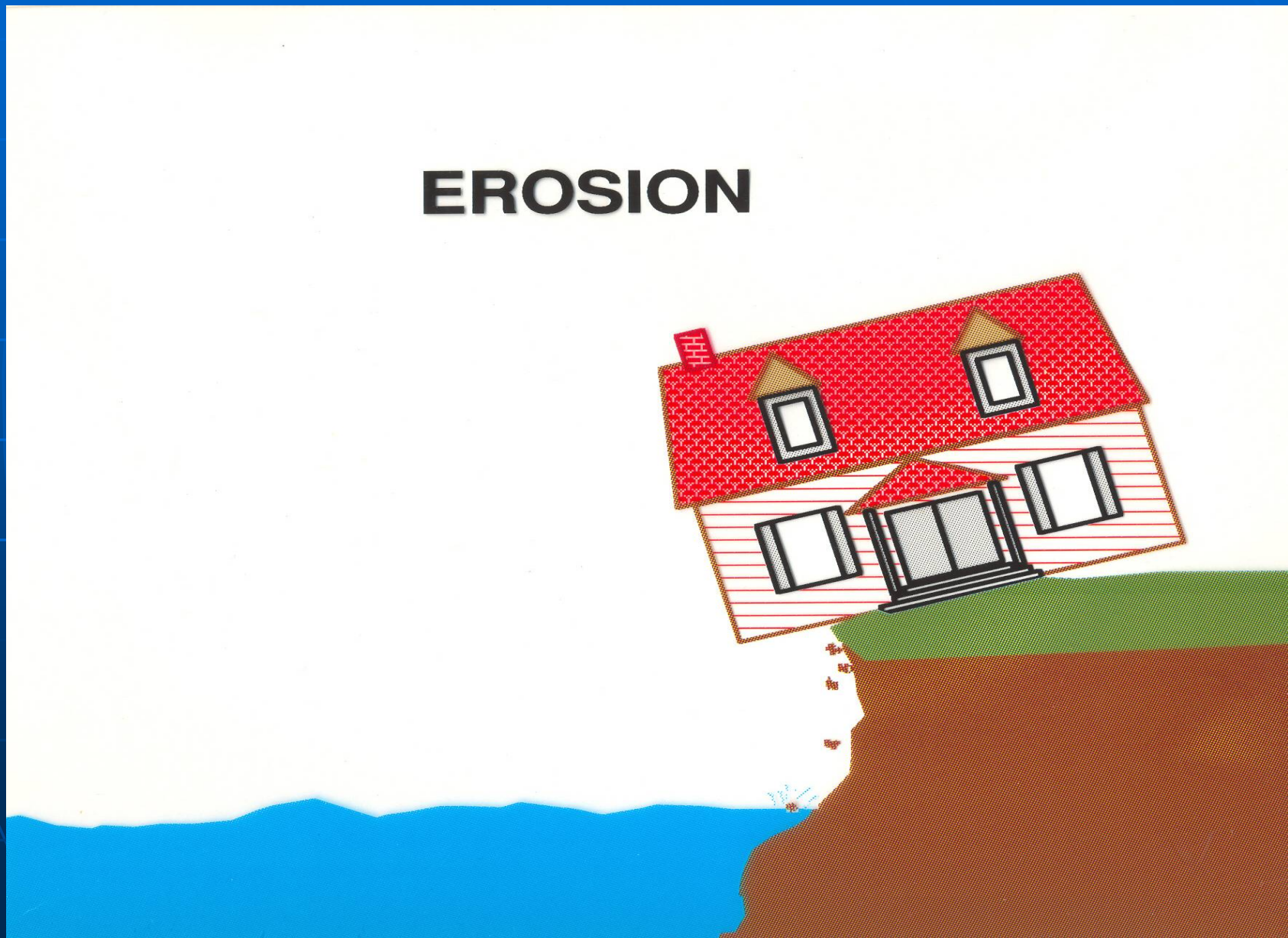
Most of these areas are currently protected by levees. They would be inundated only if those levees fail or are overtopped.

From Noah Knowles, U.S. Geological Survey, Menlo Park, CA

Results should be considered preliminary



More Coastal Erosion



Analysis Process

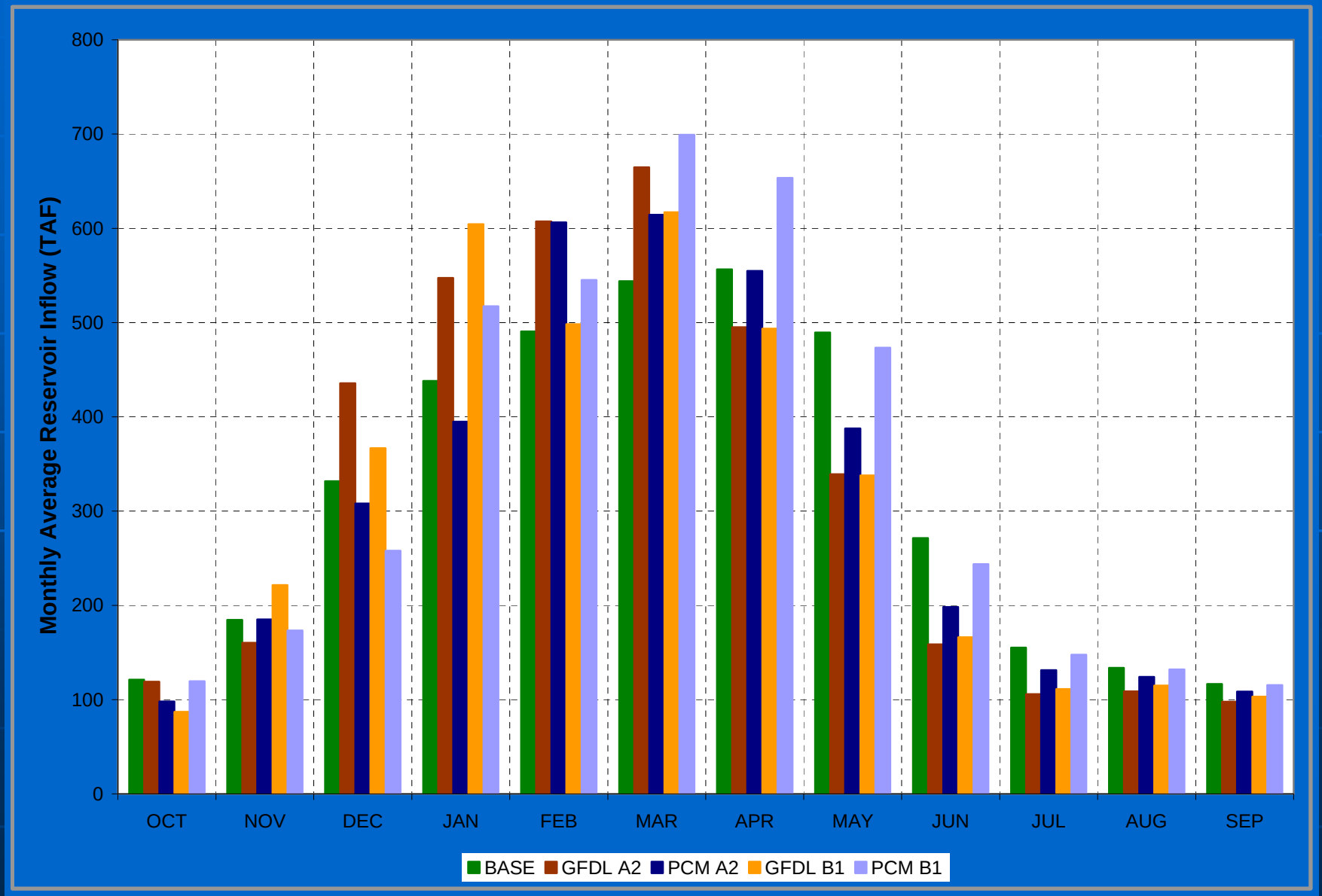
Global Modeling	Regional Downscaling	SWP & CVP Operations	Delta Flow & Water Quality
			
GFDL or PCM	VIC	CALSIM	DSM2
Air Temperature Precipitation Humidity Radiation	Streamflow Snowpack Snow melt Soil Moisture	Reservoir Ops Deliveries Storage Delta Outflow	Flow Salinity

Conducted by work team

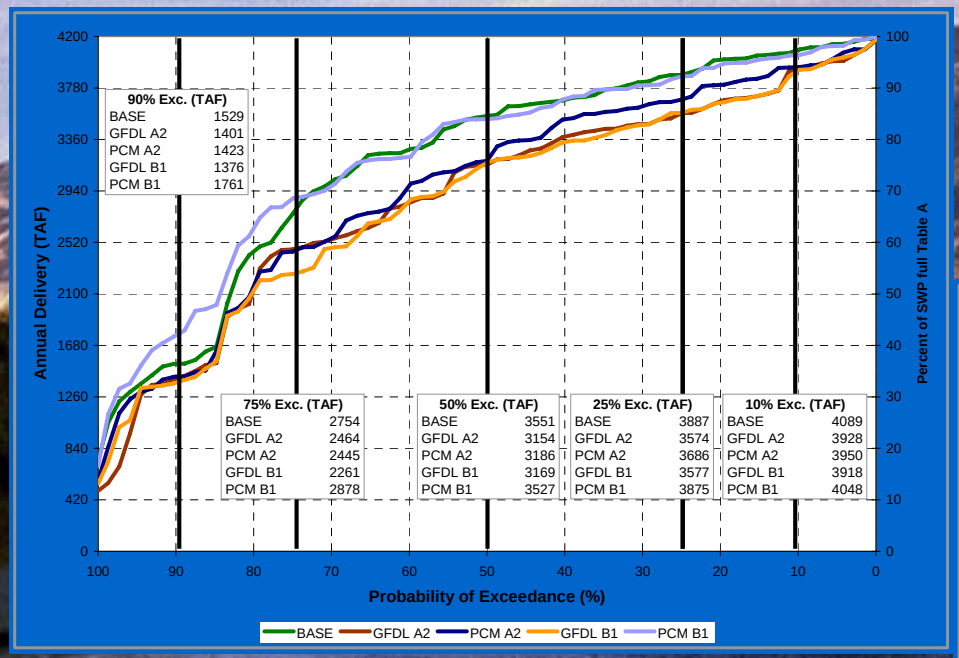
Study Assumptions

- Delta regulated by D1641
- CVPIA 3406 (b)(2) and EWA are not included
- 2020 level of development
- Climate change study inflows perturbed to reflect 2050 climate signal
- No changes in operating rules from base to climate change studies

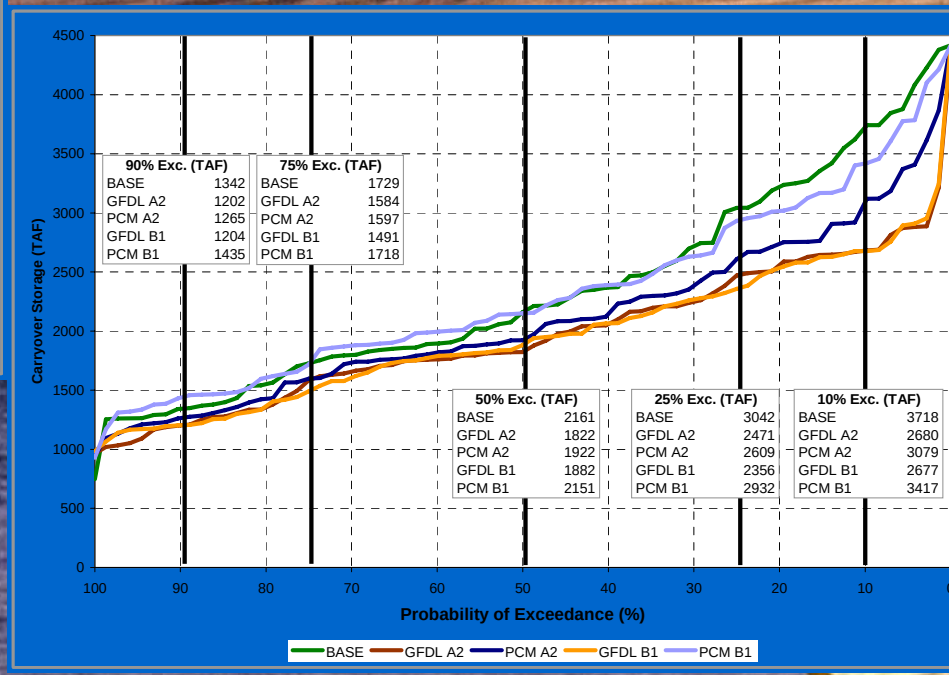
Lake Oroville Average Monthly Inflow (1922-1994)



SWP Climate Change Impacts



Exceedance Probability Plot of SWP Table A Deliveries



Exceedance Probability Plot of SWP Carryover Storage

Preliminary Operations Impacts
2050 Runoff Projections, No Sea Level Rise

- Upstream reservoir shortages during droughts
- Deliveries
  - Decreased for the dry scenarios
  - Increased slightly for wet scenario
- Carryover storage
  - Reduced for drier scenarios
  - Increased in dry years for wet scenario
- Power generation was negatively impacted for drier scenarios
- Stream temperature changes were examined

What's new for 2008?

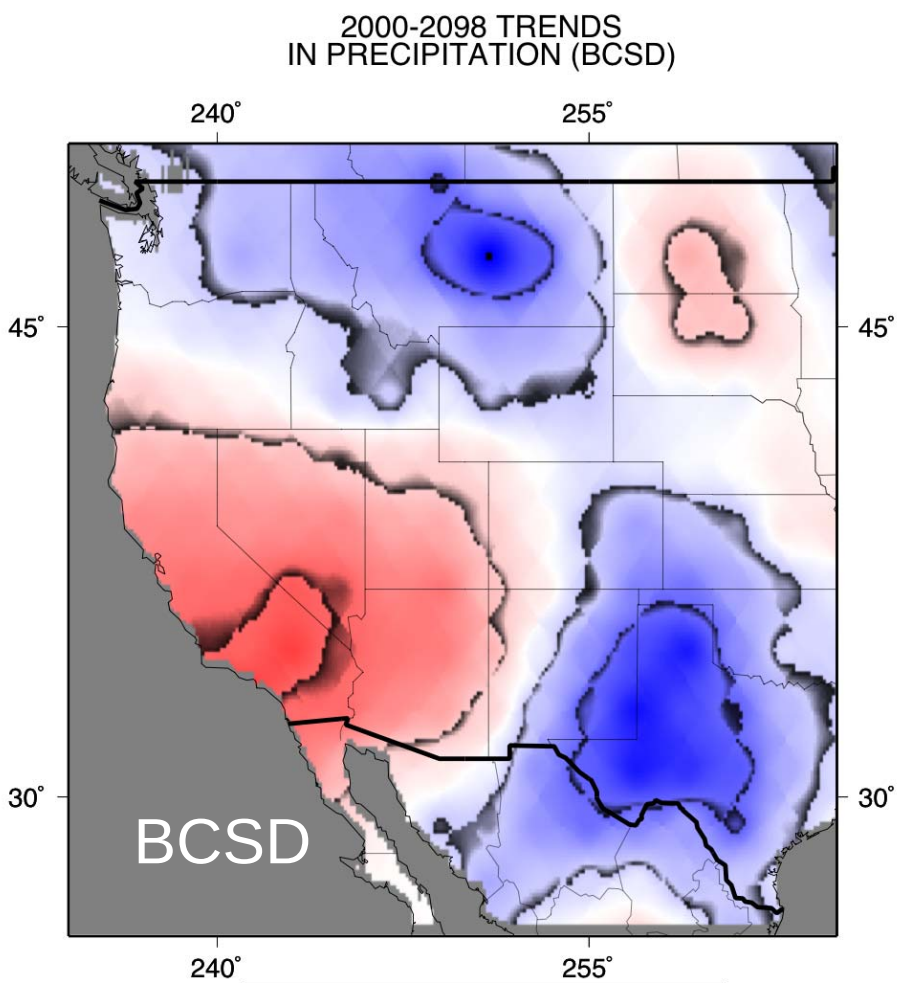
2008 CAT Team Scenarios

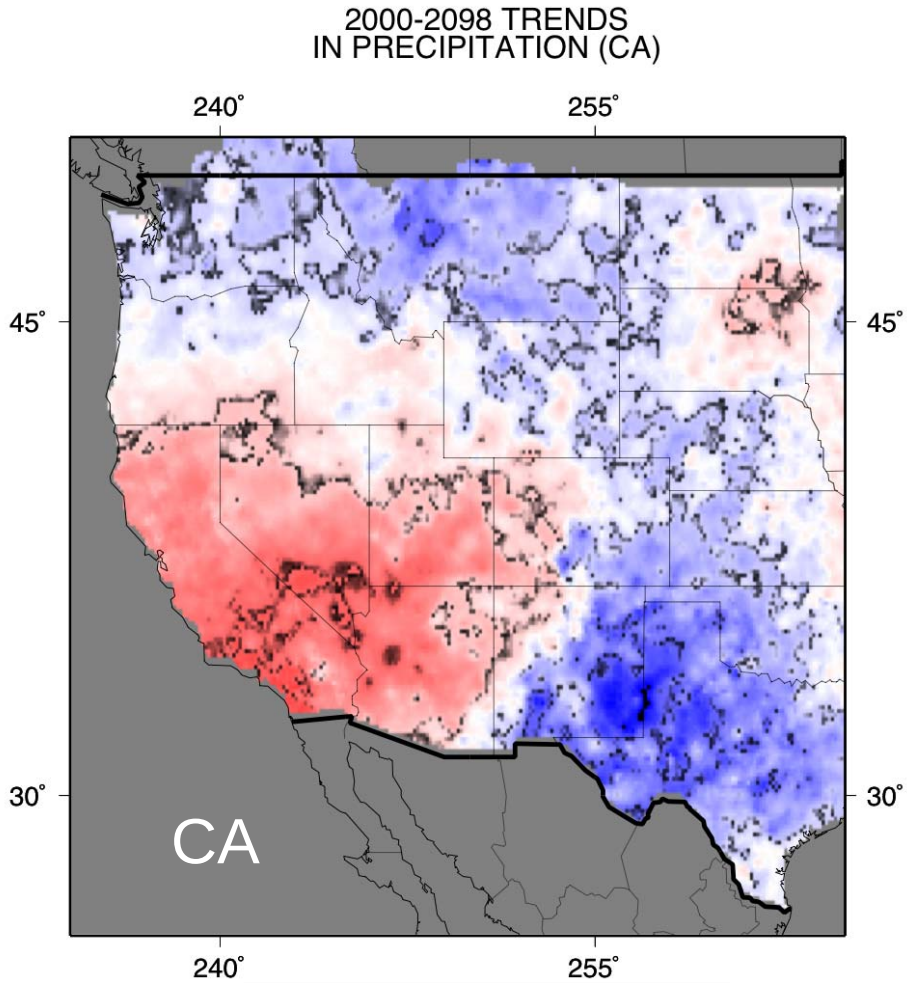
- **6 Global Climate Models**
  - GFDL-CM2.1 (USA)
  - NCAR-PCM1 (USA)
  - CNRM-CM3 (France)
  - MPI-ECHAM5 (Germany)
  - MIROC3.2med (Japan)
  - NCAR-CCSM3 (USA)
- **Two Emissions Scenarios**
  - A2
    - high population growth
    - regional economic growth
    - fragmented technological changes
  - B1
    - low population growth
    - rapid economic growth
    - sustainable technology

12 Total Scenarios = 6 GCM x 2 Emissions Scenarios

Downscaled Projected Trends in December Precipitation by Two Approaches

(GFDL CM2.1, A2 emissions, 21st Century)





Bias correction & spatial downscaling, from Ed Maurer, SCU

Constructed analog, from Hugo Hidalgo, Scripps


SHTINKY'S
TO-DO LIST...
muttscomics.com
TO HELP
STOP GLOBAL
WARMING —
1. STAY COOL
4-5

Thank You!